



UNIVERSITI TEKNIKAL MALAYSIA MELAKA

**DEVELOPMENT OF PC-BASED HEART RATE MONITORING
USING MICROCONTROLLER**

This report is submitted in accordance with the requirement of Universiti Teknikal Malaysia Melaka (UTeM) for the Bachelor of Electrical Engineering Technology (Industrial Automation & Robotics) with Honours

by

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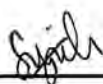
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ABSTRACT

The project describes the development of PC-based heart rate monitoring using microcontroller based. It have few systems that provide a continuous health monitoring for people or patient. Futhermore, most devices is a large and cannot bring at everywhere. A portable heart rate monitoring is personel monitoring device to measure heart rate value at anytime and anywhere. This project is specifically designed to detect heart rate through the fingertip to determine the level of health based on computer with a user-friendly features and can be used at home for the convenience of users. In addition, it allows doctors and consumers to get your heart rate 24 hours a day. This project uses a sensor to detect of the pulse at your fingertips and move the data to a PC via a serial interface. In the production of this project, it is focuses to producing and designing a heart rate monitoring that uses a microcontroller and also the computer to display the heart rate result through the computer. The project has a microcontroller that be used as a center process to the interpreting the integrated circuits and sends the data through a computer. The source code written in programming language using software and storing data in microcontroller as the central processing system the heart rate. The microcontroller will receive the data and process the data in which the results will be displayed through the computer.

ABSTRAK

Projek ini menerangkan pembangunan kadar jantung berdasarkan PC pemantauan menggunakan mikro pengawal. Ia mempunyai beberapa sistem yang menyediakan pemantauan kesihatan yang berterusan untuk orang ramai atau pesakit. Tambahan pula, ke banyak kan peranti adalah besar dan tidak boleh dibawa ke mana-mana. Pemantauan kadar jantung mudah alih adalah peranti pengawasan peribadi untuk mengukur nilai kadar jantung sebenar tidak mengira masa dan di mana mana sahaja. Projek ini direka khusus untuk mengesan kadar denyutan jantung melalui hujung jari untuk menentukan tahap kesihatan berasaskan komputer dengan mempunyai ciri-ciri mesra pengguna dan boleh digunakan di rumah untuk kemudahan pengguna. Di samping itu, ia membolehkan doktor dan pengguna untuk mendapatkan kadar denyutan jantung 24 jam sehari. Projek ini menggunakan sensor bagi mengesan nadi di hujung jari dan memindahkan data kepada PC melalui antara muka bersiri. Di dalam penghasilan projek ini, ia menumpukan kepada penghasilan dan mereka bentuk satu pemantauan kadar jantung yang menggunakan kawalan mikro serta komputer bagi mempamerkan keputusan kadar jantung melalui komputer. Projek yang dihasilkan ini mempunyai mikro pengawal yang digunakan sebagai pusat proses untuk mentafsir litar bersepadu dan menghantarkan data melalui komputer. Kod sumber ditulis dalam bahasa pengaturcaraan dengan menggunakan perisian dan menyimpan datanya di dalam micro pengawal sebagai pusat proses sistem kadar denyutan jantung. Mikro pengawal ini akan menerima data dan memproses data di mana keputusan akan dipaparkan melalui komputer.

DEDICATION

Special dedicated to

My beloved parents and siblings, also my friends, guided and supported me throughout my study. I hope this accomplishment will fulfil the dreams expected to me and thank you very much too all for their support and help me in this project.

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LIST OF ABBREVIATIONS, SYMBOLS AND NOMENCLATURE

(A/D)	-	Analogue & Digital
BPM	-	Beat Per Minute
EEPROM	-	Electrically Erasable Programmable Read Only Memory
GUI	-	Graphical User Interface
IR	-	Infrared
LabVIEW	-	Laboratory Virtual Instrument Engineering Workbench
LCD	-	Liquid Crystal Board
LED	-	Light Emitting Diode
MicroC	-	Micro Controller
PC	-	Personal Computer
PCB	-	Printed Circuit Board
PIC	-	Programmable Interface Controller
USB	-	Universal Series Bus

CHAPTER 1

INTRODUCTION

1.0 Background

Heart rate also same meaning to as pulse rate. The normal method commonly used to check the pulse is at wrist and count the number manually. Heart rate is varying according to physical, age, and activity condition. For adult, a normal resting heart beat around 60 to 100 Beats Per Minute (BPM) are normal resting pulse for adult. For athlete, heart rate might have around 40 to 60 BPM. For the baby, the heart rate is higher which is around 120 to 160 BPM. Usually, the heart rate commonly measure using the Electrocardiogram Machine (ECG). This equipment are very expensive. It is not affordable for communities. Other than that, patients need to go to a hospital or clinic to check the heart rate to determine the level of health. So, to save time and simplify the user, I would like to develop this project with use a fingertip to get a heart rate. Pulse rate can be used to measure heart rate for a normal to ensure quality of health. From a fingertip it can detect the flow of blood. Using the microcontroller, at the fingertip can be measure the heart rate considering change of blood volume. The sensor will detected the pulse signal from fingertip. The data will be transfer to the PC through a serial interface. Heart rate monitoring are monitoring device that can show the heart rate to detect health level through heart rate that can be use anytime, especially at home. Users can be use this product to check out the heart rate at home without having to the hospital or clinic. This project is combination between software and hardware. For this project, PC-based heart rate monitoring is more portable and lower cost.

1.1 Problem Statement

In the year 1996 more than 10 000 people under the age of 70 years died from heart diseases or cardiovascular diseases. According to the World Health Organization (WHO), heart diseases in Malaysia increasing from year to year. Death statistics in Malaysia shows the heart diseases is the number one killer in Malaysia. In this project, there are few problem statement carried out from this project. Usually, patient have to go to the hospital or clinic to check the heart rate to determine of the health level. This will take time of the patient to go to the hospital or clinic and waiting the turn to see a doctor to check the heart rate. Mostly, the heart rate monitoring are expensive. Futhermore, patients cannot see a doctor every time to continuous monitoring for dialysis of health level. To seeing a doctor, patient need do appointment because only one doctor can handle few patient in one time.

From the problem statement is

1. Patient need a time to go to hospital or clinic and must waiting the turn to see a doctor to determine the health level.
2. Patients cannot see a doctor every time and need to make an appointment for continuous monitoring of health level.
3. The heart rate monitoring are expensive.

1.2 Objective of project

From the problem statement that we get, the main objective in this project is:

1. To design and built heart rate monitoring system by integrating the software (programming) and hardware (electronic components) that can be used at home to determine the condition of health level..
2. To develop the PC-based heart rate monitoring system that can be used for continuous monitoring of health level.
3. To design and built a lower cost heart rate monitoring system that affordable for all level of society.

1.3 Scope of project

- Sensor (Easy Pulse V1.1)
- Microcontroller (Arduino Uno)
- USB
- Computer/PC



Figure 1.1: System of Block Diagram

Based on the Block Diagram in figure 1.1, the project scopes are to develop program for microcontroller Arduino Uno which is can display the instantaneous heart rate. In order to complete this project, there are two main parts of the scopes. It is hardware and software development. For this project, to accomplish one complete system in monitoring system, it involves two parts. For the hardware part, the scope of this project is a connection between of microcontroller (Arduino Uno) and pulse sensor. This circuit is connecting with the connection from the sensor, microcontroller, USB, and computer. For software part, it has a Arduino Uno and the pulse sensor. For the software part and interfacing identify suitable programming and its implementation into microcontroller Arduino Uno. It also can communicate with computer to displaying the result of the heart rate. Then build the complete circuit hardware and software for heart rate. To determine and control the range of heart rate in human body, the software for language programming is used to programme the microcontroller (Arduino).

1.4 Thesis Outlines

This thesis have 5 chapter that can describe different parts of the project. Each chapter will explain each part in terms of software and hardware on that chapter. The contents includes information of components used in this project.

Chapter 1 will explain the overall project in terms of objectives, statement of the problem, scope and causes of problems that create this project.

Chapter 2 will describe the literature review of current issues and reviewing previous terms of journal thesis. This chapter will also examine a bit of the components used in the project.

Chapter 3 will focus on the methodology that will be used in this project. It is have the two methods whereby will use software and hardware. It is explain on the concept, theories, principles that will be used to complete the project. Both divisions will be described.

Chapter 4 will discusses about the project result and analysis. This result outcome is divided by to which is hardware and result analysis.

Chapter 5 will discusses about the project conclusion and recommendation. It will explain the future improvement which will be made in future.

CHAPTER 2

LITERITURE REVIEW

2.0 Introduction

This Literature Review are an outline part of previous research on this topic. The reason for the literature review is to deliver what idea and knowledge that has been set up on the topic and also the weaknesses and strengths of the project. Literature review has been run before to under-taking this project to get the data on the technology accessible and the methodologies that utilized by the other analyst on the similar time topic around the world. This part gives the synopsis of literature reviews on key points identified with the heart rate monitoring.

Now, there are different with much character and of the features. This part will discuss about the heart rate monitoring that exists in the market, their specification and how it functions. Many component and software also use in this project.

Besides that, on this chapter also have a detail description about the project namely hardware and software. This chapter will explain and discuss the literature reading which is related to the development of the PC-based heart rate monitoring using microcontroller. This chapter review each component used in the project. The component involved are microcontroller, sensor, USB and some other electronic device that will be explained. At the same time, the study is to obtain and understand on how to use the software and hardware.

2.1 Heart

Muscular organ that refers to the heart. It is considered the heart of fist size, situated behind and marginally left of the breastbone. It is one of the toughest muscles that use to pump up blood from it into the entire body. It has four chambers which are right ventricle, right atrium, left ventricle, and left atrium. The right ventricle and atrium are alluded as right heart, and the counter parts of it, which are the left ventricle and atrium are alluded as left heart. This average heart will beat at 72 beat per minute and weight for approximately 300 grams until 530 grams. The heart continuously works even when our body is resting or sleeping. [HALL, 2015]

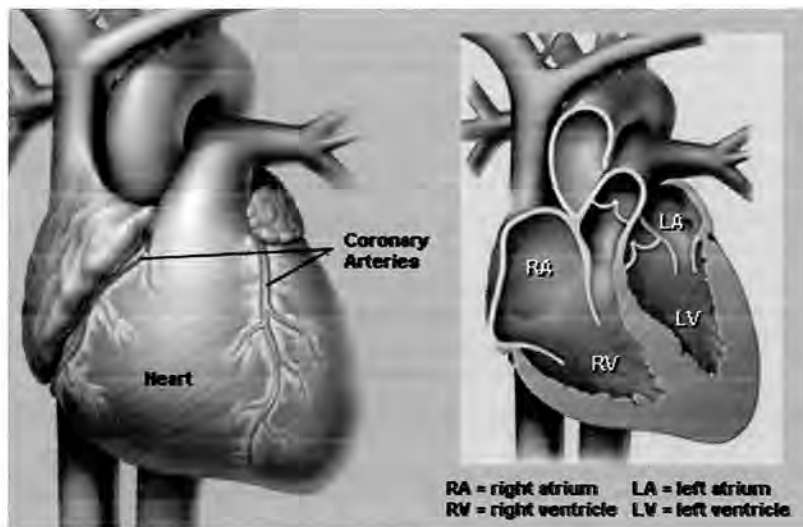


Figure 2.1: The heart system organ

2.1.1 Electrocardiograph

An electrocardiogram (ECG) is a digital instrument that empowers cardiac bio potentials will be shown, measured, and analysed. A diagnostic electrocardiogram (ECG) is utilized for get an arrangement of conventional electrocardiogram (ECG) marks which precisely represent detail waveform and beat-to-beat fluctuation. The cardiovascular monitor are an electrocardiograph use to acquire heartbeat sign, show pulse, and additionally

ECG waveforms, and give cautions when heart stop, bradycardia or tachycardia are recognized. Heart biopotentials start from sinoatrial (SA) hub. From the SA hub, an excitation are directed over the working myocardium of both atria, starting atrial contraction. The excitation is then quickly deferred in the atrioventricular (AV) hub, permitting the atrial blood to enter the ventricles. From the AV hub, the excitation rapidly moves at a velocity around 2 m/s through the rest framework from left and right bundle branches. By measuring cardiac bio-potentials as electrocardiograms, the excitation can be observed . Finally, a diagnostic 12-lead ECG is utilized to analyse heart arrhythmias. [GAIL D. BAURA, 2012]

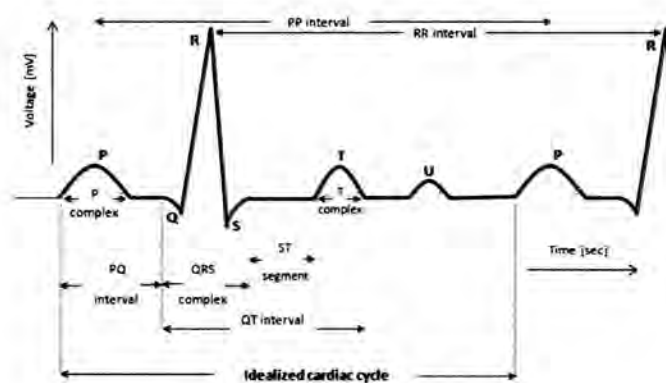


Figure 2.2: The pattern for the ECG signal

2.1.2 Heart Rate Measurement

Heart rate are the speed of the pulse measure by the quantity of the heart beat per minute (BPM). Pulse is the diverse for each human according to the physical needs of the body. It also by the need to ingest excrete carbon dioxide and oxygen. By doing exercises, for example is a physical work out, stress, sleeping, uneasiness, illness, or ingestion of drug can cause changes in heart rate. Around the 60-100 BPM is the normal human heart rate. For athlete, the heart rate might have around 40 to 60 BPM. For the baby, the heart rate is higher which is around 120 to 160 BPM. To measure the heart rate with the manual method is to place the index finger of the neck or on the wrist and in 20 seconds count the number of beats and multiply by 3.